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Rapid Communication

First records of the round goby *Neogobius melanostomus* (Pallas, 1814) in the Elbe River, Germany

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Abstract

The round goby *Neogobius melanostomus* (Pallas, 1814), a Ponto-Caspian gobiid species, was recorded for the first time in the Elbe River, Germany in May 2008. Between then and June 2013, 22 records comprising 36 specimens of *N. melanostomus* have been collected from the Elbe River, mainly in the tidal river section of the city of Hamburg.

Key words: *Neogobius melanostomus*; round goby; Gobiidae; Elbe River; Germany; non-indigenous species

Introduction

The round goby *Neogobius melanostomus* (Pallas, 1814) is a Ponto-Caspian gobiid species. Its natural distribution comprises the Black, Azov and Caspian Seas and their tributaries (Miller 1986). The species prefers waters with rocky substrates like stone packing and cobble (Ray and Corkum 2001) but also inhabits flat sandy or muddy soft areas (Johnson et al. 2005) if more diverse substrate for spawning is available in nearby areas (Sapota and Skora 2005). The round goby reaches a maximum total length of 250 mm (Sapota 2006) and has a broad diet chiefly feeding on bivalves, small crustaceans and polychaetes (Corkum et al. 2004; Miller 1986). Its tolerance of a wide range of environmental factors (Sapota 2006; Corkum et al. 1998) and ability to spawn several times a year and high fecundity (MacInnis and Corkum 2000) promotes the successful spreading of the species.

Materials and methods

On May 9th 2008, the first individual of *N. melanostomus* was caught in the tidal Elbe River, Germany at 53°31'28"N and 9°59'11"E (Figure 1, Appendix 1) by a commercial fisherman and was subsequently frozen. The fish was transferred (by Reinhard Diercking) to the fish collection of the Zoological Museum Hamburg (ZMH) for species identification and preservation in 70% ethanol after defrosting. The specimen was deposited in the ZMH fish collection under catalogue number ZMH 25592. From 2011 to 2013, 20 further records were provided, mostly by anglers, comprising 34 specimens of round goby from the tidal Elbe River section of the city of Hamburg (Appendix 1). One additional record (Appendix 1, record No. 9) was obtained further upstream close to the city of Geesthacht. Five of these specimens were transferred to the ZMH, preserved in 70% ethanol and stored under separate catalogue numbers in the fish collection (Table 1). Morphometric measurements were done on the left side of each specimen following Hubbs and Lagler´s (1958) method. Meristic characters were counted and fish were identified according to Miller (1986) and Kottelat and Freyhof (2007). Vertebrae, and the spines and rays of dorsal and anal fins of all specimens were counted from radiographs (Figure 2) using an X-ray imaging system. Sexes were identified following Kornis et al. (2012), based on the shape and length of the urogenital papilla.

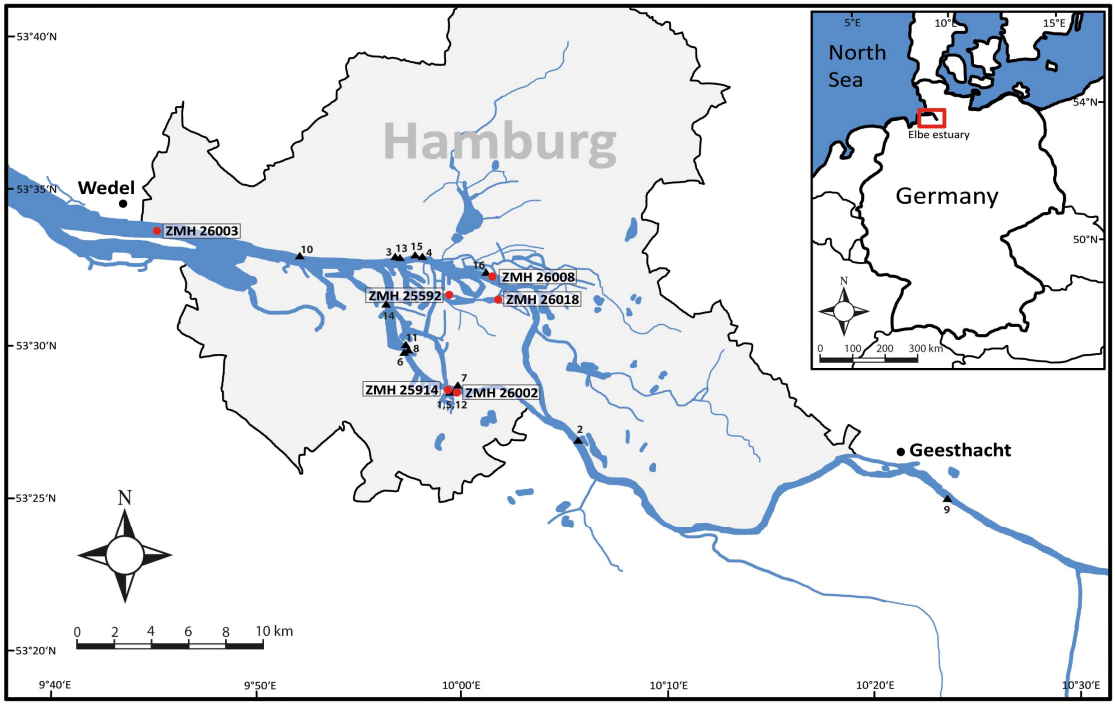

Figure 1. Map with the new records of *Neogobius melanostomus* in the River Elbe. Red spots and ZMH numbers indicate specimens stored in the ZMH fish collection. Black triangles and numbers show additional recorded specimens.

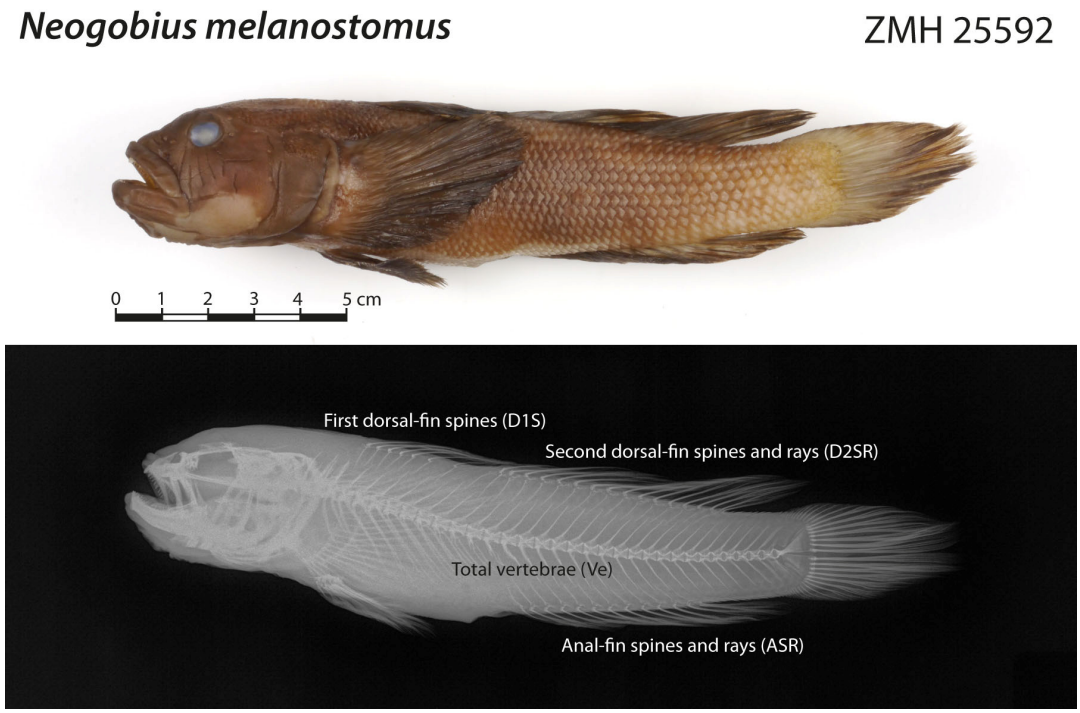

Figure 2. Round goby, *Neogobius melanostomus*, ZMH 25592, 189 mm TL, captured from the tidal River Elbe, Germany, on May 9th 2008. Picture (above) and X-ray (below) taken after preservation in ethanol, meristic characters taken from X-rays are indicated.

Table 1. Morphometric measurements and meristic counts for the new records of six specimens of *Neogobius melanostomus* stored in the ZMH fish collection. Total weight is given in grams. Total and standard lengths are in millimetres, other measurements are expressed as a percentage of standard length.

Characters	*Neogobius melanostomus*					
	ZMH 25592	ZMH 25914	ZMH 26002	ZMH 26003	ZMH 26008	ZMH 26018
Total length (TL)	189	121	118	151	71	140
Standard length (SL)	151	98	98	123	59	116
Total weight (TW)	87.69	22.63	23.37	65.33	4.21	42.27
First dorsal-fin spines (D1S)	VII	VI	VI	VI	VI	VI
Second dorsal-fin spines and rays (D2SR)	I,16	I,15	I,15	I,15	I,15	I,15
Anal-fin spines and rays (ASR)	I,12	I,12	I,12	I,12	I,12	I,12
Pelvic-fin spines and rays (VSR)	I,5	I,5	I,5	I,5	I,5	I,5
Pectoral-fin rays (PR)	18	18	18	18	17	18
Lateral line scales (LL)	55	54	55	54	55	55
Predorsal area scaled (PS)	+	+	+	+	+	+
Black Spot on posterior part of first dorsal-fin (BS)	+	+	+	+	+	-
Total vertebrae (Ve)	33	33	33	33	32	33
Sex	male	female	female	male	male	male
% SL						
Body depth (BD)	22.7	26.3	26.3	27.8	20.7	27.1
Head length (HL)	27.7	27.2	27.2	27.0	27.8	26.6
Head depth (HD)	21.7	19.8	19.8	24.4	18.0	21.7
Head width (HW)	25.6	21.1	21.1	25.4	25.6	21.9
Snout length (SnL)	8.8	9.8	9.8	9.6	9.7	9.1
Postorbital head length (PHL)	15.8	14.0	14.0	14.3	13.9	13.4
Orbit diameter (OD)	5.3	8.0	8.0	6.4	7.5	6.7
Interorbital width (IW)	5.7	5.3	5.3	6.7	5.4	5.9
Caudal peduncle depth (CPD)	12.4	11.6	11.6	12.4	12.5	11.6
Caudal peduncle length (CPL)	13.0	15.5	15.5	13.2	18.1	15.8
Prepectoral length (PPL)	29.4	30.3	30.3	28.9	29.5	29.7
Prepelvic length (PVL)	31.5	30.9	30.9	29.2	30.5	30.7
Predorsal length (PD1L)	32.4	37.2	37.2	33.5	35.1	33.8
Preanal length (PAL)	58.3	58.0	58.0	57.6	58.0	56.4
First dorsal-fin height (D1H)	12.1	13.6	13.6	14.8	14.4	12.2
Pectoral-fin length (PL)	30.3	28.3	28.3	27.0	29.2	28.1
Pelvic-fin length (VL)	19.5	21.6	21.6	22.2	22.9	20.4
Orbit diameter/Interorbital width (OD/IW)	0.93	1.50	1.50	0.96	1.38	1.15
Orbit diameter/head length (OD/HL)	0.19	0.29	0.29	0.24	0.27	0.25
Pelvic-fin insertion to anal-fin origin (VI-AO)	28.1	29.8	29.8	28.8	29.0	28.4

Results and discussion

Brief description of the specimens deposited in the ZMH fish collection:

These six specimens of *N. melanostomus* were represented by four males and two females with total weight 4.21–87.69 g and total length 71–189 mm (Table 1). This size range comprises juvenile and adult round gobies. The body is elongate and round in cross section. Pelvic fin lengths of the specimens were 0.7–0.8 times the distance from the pelvic-fin insertion to the anal-fin origin. Pelvic fins do not reach the anus. Colour is brown to yellowish-grey, with several lateral blotches. The first dorsal fin has a large black spot in the posterior (except ZMH 26018). The predorsal area is scaled. Further characters are given in Table 1.

Identification

The reported specimens agree well with the coloration, body shape, counts and measurements presented by Miller (1986) and Kottelat and Freyhof (2007). The specimen (ZMH 26018) without a black spot on the posterior part of the first dorsal fin is reliable identified as *N. melanostomus* based on all other counts and measurements and an additional investigation of the structure of the rows of sub-orbital papillae (Miller 1986).

Distribution

Nowadays the round goby is one of the most wide-ranging invasive fish species on earth with substantial introduced populations in several European rivers systems, the Baltic Sea and the Laurentian Great Lakes (Kornis et al. 2012). The species is currently spreading in European rivers (Kalchhauser et al. 2013). Westwards of the Elbe River, the round goby was recorded for the first time in the Dutch Rhine delta (van Beek 2006) in 2004, in the River Scheldt and the Albert Canal in 2010 (Verreycken et al. 2011) and in the River Weser in 2012 (Brunken et al. 2012). Eastwards, in the Baltic Sea, *N. melanostomus* has developed high abundance in many regions (Kornis et al. 2012). The new records of *N. melanostomus* in the Elbe River (Figure 1) can close the distribution gap of round goby between the western and eastern records. The records of adult male and female individuals, the relatively high number of records in 2012 and 2013 and the occurrence of juvenile and adult specimens suggest the establishment of the species in the tidal Elbe River. One preferred substrate of the round goby, stone packing (Borcherding et al. 2011) and stony groynes, large man-made hydraulic structures directing the river current, are common at the banks of the Elbe. The presence of these man-made substrates could support further spreading into regions upstream and downstream from the recent records. Both natural dispersal and transport via commercial shipping are possible ways of introduction of *N. melanostomus* into new areas (Kornis et al. 2012). The port of the city of Hamburg in the Elbe River is the 15th-largest port worldwide and is visited by about 12,000 ships every year (HPA 2013). Therefore, round gobies are likely to have plentiful opportunities to reach the tidal Elbe River section around Hamburg within ballast water tanks of ships. Although it is not clear from which original localities the recorded specimens stem, the observation of an individual without a large black spot in the posterior part of the first dorsal fin maybe indicates that at least some of the specimens could originate from the Laurentian Great Lakes. There, specimens of *N. melanostomus* without a black spot on their first dorsal fin were reported from Lake Erie (ISSG 2013). Natural dispersal from the Baltic Sea, as another possible source, seems more improbable because of the lack of early records in the Elbe estuary downstream of the city of Hamburg. Future genetic analysis could help to clarify the origin of the round gobies recorded in the Elbe River.

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Appendix 1. Records of *Neogobius melanostomus* in the Elbe River.

Catalogue or record number	Location	Records coordinates		Record Date	No. specimens	Source
		Latitude, N	Longitude, E			
Specimens stored in the ZMH fish collection						
ZMH 25592	Veddel channel, Hamburg	53°31'28"	9°59'11"	09/05/2008	1	commercial fisherman, Reinhard Diercking
ZMH 25914	Harburg, Hamburg	53°28'24"	9°59'17"	19/10/2012	1	angler
ZMH 26002	Harburg, Hamburg	53°28'22"	9°59'28"	04/05/2013	1	first author
ZMH 26003	Neßsand, Hamburg	53°33'37"	9°45'02"	22/05/2013	1	commercial fisherman
ZMH 26008	Veddeler Brückenstraße, Hamburg	53°31'58"	10°01'38"	14/06/2013	1	first author
ZMH 26018	Müggenburger Zollhafen, Hamburg	53°31'19"	10°01'39"	07/07/2013	1	angler
Additional records not stored in the ZMH fish collection						
1	Harburg, Hamburg	53°28'24"	9°59'17"	23/09/2011	1	angler
2	Oortkaten, Hamburg	53°26'46"	10°05'37"	Oct. 2011	1	angler
3	Fischmarkt, Hamburg	53°32'37"	9°56'47"	24/03/2012	1	angler
4	Landungsbrücken, Hamburg	53°32'43"	9°58'12"	29/03/2012	1	angler
5	Harburg, Hamburg	53°28'22"	9°59'23"	13/05/2012	1	angler
6	Kattwykbrücke, Hamburg	53°29'36"	9°57'00"	14/06/2012	4	angler
7	Finkenried, Hamburg	53°28'23"	10°00'18"	16/07/2012	4	angler
8	Kattwykbrücke, Hamburg	53°29'34"	9°57'19"	15/08/2012	1	angler
9	near Geesthacht	53°24'48"	10°23'26"	Aug. 2012	1	commercial fisherman
10	Teufelsbrück, Hamburg	53°32'46"	9°51'48"	12/09/2012	1	angler
11	Kattwykbrücke, Hamburg	53°29'43"	9°57'10"	22/09/2012	2	angler
12	Harburg, Hamburg	53°28'24"	9°59'17"	11/10/2012	5	angler
13	Fischmarkt, Hamburg	53°32'38"	9°57'03"	Nov. 2012	2	angler
14	Köhlbrand, Hamburg	53°31'18"	9°56'12"	01/05/2013	2	angler
15	Landungsbrücken, Hamburg	53°32'44"	9°57'39"	22/05/2013	2	angler
16	Zweibrückenstraße, Hamburg	53°32'04"	10°01'20"	07/07/2013	1	angler